

REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

By the foregoing amendment, claim 1 has been amended. Thus, claims 1, 2, 4, 5, and 7 are currently pending in the application and subject to examination.

Claims 1, 2, 4, 5, and 7 Recite Patentable Subject Matter

In the Office Action mailed November 3, 2004, claims 1, 2, 4, 5, and 7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 11-307791 (JP '791), in view of U.S. Patent 6,300,556 to Yamagishi et al. (Yamagishi) and in further view of U.S. Patent No. 5,942,050 to Green et al. (Green). Claims 1, 2, 4, 5, and 7 were also rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,353,042 to Hanoka et al. (Hanoka) in view of Yamagishi, JP '791, and Green. Applicant notes that claim 1 has been amended. To the extent that these rejections apply to the claims currently pending, Applicant respectfully traverses the rejections, as follows.

Claim 1 recites, in part:

the crystalline silicon substrate is positioned between the thin film amorphous semiconductor layer, which forms the p-n junction with the crystalline silicon substrate, and the light incidence side light transmitting member, such that light enters the solar cell element at a side thereof that is opposite the thin film amorphous semiconductor layer.

The outstanding Final Office Action asserts that "regarding the position of the crystalline substrate with respect to the thin film amorphous layer and the light incidence side light transmitting member, the solar cell module of JP '791 allows light to enter from both sides. Therefore, light coming in from either direction contributes to the generation of electricity. Because both sides of the solar cell are light transmitting and the

incidence depends on the installation of the solar cell with respect to the light source, the position of the crystalline substrate with respect to the 'light incidence side member' is irrelevant. Therefore, the claimed placement is an obvious rearrangement of parts."

See the Office Action of November 3, 2004, at page 4, lines 14-21.

Applicant respectfully submits that JP '791 discloses a glass plate 3 provided at a front surface side of a module where there is more incident light, and the light-transmitting sheet 4 is provided at the rear surface side of the module where there is less incident light. In a solar cell using a crystalline silicon substrate, the importance of bringing a p-n junction as close as possible to the light incidence side is well known in the art, since short wavelength light of a high absorption coefficient is specifically absorbed in the vicinity of a front surface (light incidence side) of a solar cell. It is also well known in the art that carriers generated in the vicinity of the front surface of a solar cell may disappear due to recombination, etc. before reaching a p-n junction if the p-n junction is placed at a deeper position. Therefore, the structure of the claimed invention, in which the p-n junction is placed at a position distanced from the main light incidence side of the solar cell element was neither known nor obvious to one of ordinary skill in the art at the time the invention was made.

Applicant notes that, as expected, the p-n junction of JP '791 is placed nearer to the side of the glass plate where there is more incident light. Therefore, at least the feature of the position of the p-n junction, i.e., at a side of the solar cell element that is opposite the light incidence side light transmitting member, is neither disclosed nor suggested by JP '791. Moreover, the position of the p-n junction with respect to the

light transmitting member is not just a rearrangement of parts, as suggested in the outstanding Office Action. *Id.*

Applicant further submits that the book Solar Energy Engineering, Solar Cell by Yoshihiro Hamakawa and Yukinori Kuwano, advanced electronics series I-3, Baifukan Co., Ltd., 1994, p. 65, II. 24-25, and p. 66, II. 15-21, (in Japanese) discloses:

An n+p junction is formed by forming an n+ layer on a surface (n+ means that an n type impurity is doped in large quantities). The junction is usually positioned at a depth of about 0.5 μm .

Short wavelength light of a high absorption coefficient is absorbed in the vicinity of a front surface, where electron-hole pairs are generated. When the junction is placed at a deeper position, fewer minority carriers generated in the vicinity of the front surface may reach the junction. Similarly, when the surface recombination velocity is high, generated electron-hole pairs immediately disappear by recombination, resulting in fewer minority carries reaching the junction. It has been suggested that a junction positioned at as shallow a position as possible (a depth of 0.1~0.2 μm) and a lower surface recombination velocity are preferable for improving short wavelength response in order to increase photoelectric current.

As previously noted, at the time the present invention was made, it was common knowledge for a person of ordinary skill in the art to place the semiconductor junction at a shallower position, namely nearer to a light incidence side. Contrary to this common knowledge, in the claimed invention, the semiconductor junction is deliberately disposed at the opposite side of the light incidence side in a solar cell, so that sodium ions deposited from the front surface glass can be suppressed from reaching to the semiconductor junction of the solar cell, resulting in slower degradation of power generation performance of the solar cell element.

Therefore, Applicant respectfully submits that the present invention provides a highly reliable solar cell module capable of withstanding longer-term use outdoors, which is novel and inventive.

In addition, the outstanding Office Action asserts:

It would have been obvious ...to have modified the solar cell element of JP '791 by deleting the intrinsic layer because the omission of an element and its function is obvious if the function is not desired and Green et al. teach that intrinsic layers are optional.

See the Office Action of November 3, 2004, at page 7, lines 16-20.

Applicant respectfully submits that the solar cell disclosed in Green uses an amorphous layer during manufacturing processes. However, the amorphous layer is eventually crystallized to have p-type, intrinsic, and n-type, polycrystalline layers. The solar cell disclosed in Green does not combine crystalline semiconductor and amorphous semiconductor. Accordingly, Applicant respectfully submits that the combination of JP '791 and Green is not obvious.

To establish *prima facie* obviousness of a rejected claim, the applied art of record must teach or suggest each and every feature of a rejected claim. See M.P.E.P. §2143.03. As explained above, none of view of JP'791, Yamagishi and Green, alone or combined, discloses or suggests each and every feature of independent claim 1. Thus, Applicant respectfully submits that independent claim 1 is neither anticipated nor rendered obvious by the combination of JP'791, Yamagishi and Green. Accordingly, Applicant respectfully submits that independent claim 1 is patentably distinct over the cited combination and in condition for allowance.

Claims 2, 4, 5, and 7 depend from claim 1. Therefore, claims 2, 4, 5, and 7 are allowable for the same reasons as claim 1, as well as for the additional subject matter recited therein.

Asserted 35 U.S.C. § 103(a) Rejection over Yamagishi, JP'791, Careen and Hanoka

As noted in the outstanding Office Action, the solar cell module of Hanoka includes a front surface light transmitting member 26 made of glass and a rear surface member 28 made of film. The outstanding Office Action, however, asserts that "either orientation of the crystalline substrate with respect to the light transmitting member and amorphous layer is equally efficient." *See the Office Action of November 3, 2004, at page 8.*

Applicant respectfully submits that, at the time the invention was made, it was well known in the art to bring a p-n junction as close as possible to the light incidence side. Accordingly, the glass light transmitting member 26 of Hanoka is provided at the front surface side of the solar cell, where it is assumed there will be more incident light, and one of ordinary skill in the art would place a p-n junction nearer to the glass light transmitting member 26. In contrast, in the claimed invention, the p-n junction is placed at a position of the solar cell element opposite the light transmitting member. Moreover, based on the teachings of the cited references and the level of ordinary skill in the art at the time the invention was made, Applicant respectfully submits that the orientation of the crystalline substrate with respect to the light transmitting member and amorphous layer is not equally efficient.

The outstanding Office Action further asserts:

Hanoka et al. teach that both the front surface light transmitting member and the rear surface member can be

made of glass. Since both sides are light transmitting and made of glass, both possible orientations are satisfied. *Id.*

The present invention, however, is limited to a solar cell element in which a light incidence side light transmitting member is made of a glass, and a rear surface member is a resin film. Therefore, Applicant respectfully submits that Hanoka fails to disclose or suggest the solar cell of claim 1, in which the p-n junction is positioned at a side of the solar cell element opposite the light incidence side, and nearer to the resin rear surface.

To establish *prima facie* obviousness of a rejected claim, the applied art of record must teach or suggest each and every feature of a rejected claim. See M.P.E.P. §2143.03. As explained above, none of Yamagishi, JP'791, Careen and Hanoka, alone or combined, discloses or suggests each and every feature of independent claim 1. Thus, Applicant respectfully submits that independent claim 1 is neither anticipated nor rendered obvious by the combination of Yamagishi, JP'791, Careen and Hanoka. Accordingly, Applicant respectfully submits that independent claim 1 is patentably distinct over the cited combination and in condition for allowance.

Claims 2, 4, 5, and 7 depend from claim 1. Therefore, claims 2, 4, 5, and 7 are allowable for the same reasons as claim 1, as well as for the additional subject matter recited therein.

For all of the above reasons, it is respectfully submitted that claims 1, 2, 4, 5, and 7 are patentably distinct over the cited art of record and in condition for allowance. Accordingly, withdrawal of the 35 USC § 103(a) rejections of claims 1, 2, 4, 5, and 7 are respectfully requested.

Conclusion

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of time. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300.

Respectfully submitted,

Arent Fox PLLC

Michele L. Connell
Michele L. Connell
Registration No.: 52,763

Customer No. 004372
1050 Connecticut Ave. NW
Suite 400
Washington, D.C. 20036-5339
Tel: (202) 857-6104
Fax: (202) 857-3985

MLC:mmi

Enclosure: Petition for Extension of Time